

# Burroughs Instruction Book

## Class 2 Machines

Book No. 205

PROPERTY OF AND TO BE RETURNED TO

**BURROUGHS ADDING MACHINE COMPANY**  
DETROIT, MICHIGAN



## INTRODUCTION

This book is intended as a guide to instruction in the mechanism of Class 2 machines. It is based upon the assumption that the student has already mastered the construction and operation of the Class 1 machines, as provided for in the instruction book.

Class 2 machines possess all the possibilities of the Class 1 machines, and in addition are so constructed that they may carry two separate accounts or totals. Only the particular mechanical parts and operations relative to the added functions will be treated in this book.

The student is urged to continue the practice of self-questioning as outlined in the Class 1 book, since this provides a means of understanding the operations of the Class 2 machine more fully and quickly.

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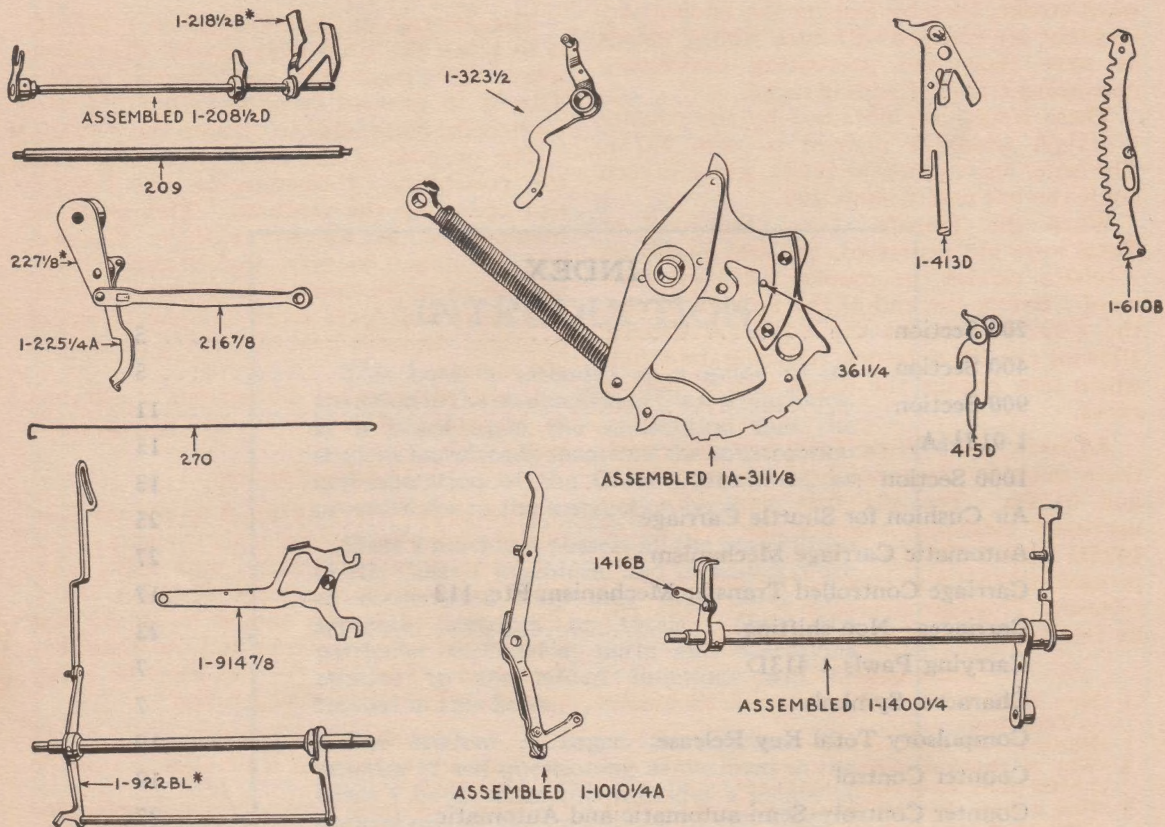


## INDEX

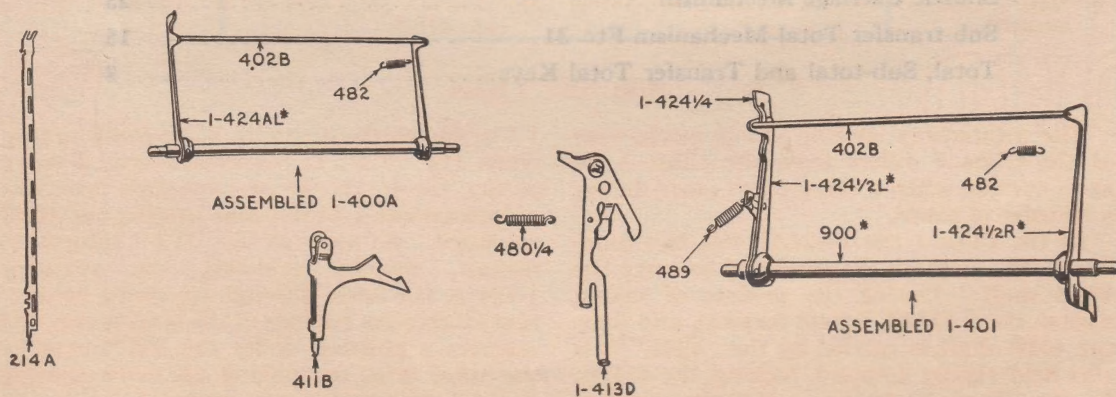
200 Section.....	5
400 Section.....	5
900 Section.....	11
1-918 $\frac{1}{8}$ A.....	15
1000 Section.....	13
Air Cushion for Shuttle Carriage.....	25
Automatic Carriage Mechanism.....	27
Carriage Controlled Transfer Mechanism Fte. 113.....	17
Carriages—Non-shifting.....	23
Carrying Pawls 1-413D.....	7
Character Symbols.....	7
Compulsory Total Key Release.....	19
Counter Control.....	19
Counter Control—Semi-automatic and Automatic.....	27
Positive Counter Control—Fte. 78.....	21
Shuttle Carriage Mechanism.....	23
Sub-transfer Total Mechanism Fte. 31.....	15
Total, Sub-total and Transfer Total Keys.....	8



## 200 SECTION



## 400 SECTION





## 200 SECTION

Printing a clear signal when the counters are clear, or in printing a total where only a part of the sectors are used, the 209 shaft, which raises the 415D, is released before the end of the forward stroke, thereby locking the adding sectors that are engaged with such adding wheels as were clear and preventing unnecessary downward travel of adding racks.

These results are obtained by the coupler 1-225 $\frac{1}{4}$ A which is pivoted to arm 227 $\frac{1}{8}$ . The latter also carries the 216 $\frac{7}{8}$ , which in turn holds the left end of shaft 209.

When the Transfer Total, Sub-total or Total keys are depressed, the arm 1416B on 1-1400 $\frac{1}{4}$  carries the coupler 1-225 $\frac{1}{4}$ A rearward. Before the end of the forward stroke, the 1-922BL releases the 1-225 $\frac{1}{4}$ A thereby allowing the 209 to return, releasing the 415Ds which now engage the upper step of adding racks.

**Adjustment.** With Total key depressed, there must be clearance between the 415Ds and 610Bs. Try the first one. To get necessary clearance advance the contact of 1416B with 1-225 $\frac{1}{4}$ A. With Total key depressed, 1-225 $\frac{1}{4}$ A to clear 1416B before 120 is released. To secure clearance adjust 1-225 $\frac{1}{4}$ A, by bending down or slightly twisting.

## SELF-QUESTIONS

- 1—How is arm 227 $\frac{1}{8}$  which moves shaft 209 coupled to Total key?
- 2—How is the 209 shaft released?
- 3—Why is clearance necessary between 415D and 1-610B when Total key is depressed?
- 4—How is more clearance between 415D and 1-610B obtained, Total key depressed?
- 5—Why should 1-225 $\frac{1}{4}$ A clear 1416B with Total key depressed before 120 is released?
- 6—How is clearance between 1-225 $\frac{1}{4}$ A and 1416B secured?

7—Why should 1-225 $\frac{1}{4}$ A have full hold on 1416B?

8—What adjustment is necessary for full hold of 1416B on 1-225 $\frac{1}{4}$ A?

1-218 $\frac{1}{2}$ B

The function of the 1-218 $\frac{1}{2}$ B on 1-208 $\frac{1}{2}$ D is to block the total keys against depression when shift lever has been partly moved. This is to prevent bending of 1-710 $\frac{3}{4}$  and connecting parts; also to actuate the 1-323 $\frac{1}{2}$ .

The purpose of the 1-323 $\frac{1}{2}$  is to prevent the possibility of disengaging the 1-914 $\frac{7}{8}$  and operating the machine. This could be manipulated as follows: 1-323 $\frac{1}{2}$  disabled, add 99 upper counter, and transfer total, add 88 in upper counter and transfer total, now move shift lever about half way to center position. Observe hold of 1-914 $\frac{7}{8}$  on stud in 900 section.

It also prevents the disengaging of counters at beginning of return stroke, and possible lock.

## Adjustments

With shift lever 1-1010 $\frac{1}{4}$ A in central position of guide slot, see that 1-323 $\frac{1}{2}$  clears 361 $\frac{1}{4}$ .

Clearance of the 1-323 $\frac{1}{2}$  and 361 $\frac{1}{4}$  is secured by stoning the ledge of the 1-323 $\frac{1}{2}$ . The operating handle should be in the last stop on the forward stroke and the Total key depressed. The 1-323 $\frac{1}{2}$  can then be easily stoned. (Test 119 for length first.)

## SELF-QUESTIONS

- 9—What are the functions of 1-218 $\frac{1}{2}$ B on 1-208 $\frac{1}{2}$ D and 1-323 $\frac{1}{2}$ ?
- 10—What would result if the 1-323 $\frac{1}{2}$  was removed and the machine operated with the shift lever in center of slot and one or more 1-413Ds in a tripped position, lower counter active?
- 11—How is 1-323 $\frac{1}{2}$  adjusted to clear 361 $\frac{1}{4}$  stud in 1A-311 $\frac{1}{8}$ ?

## 400 SECTION

The compulsory spacing stroke mechanism of the Class 2 differs from the Class 1, so as to operate when a carry takes place during a transfer of totals.

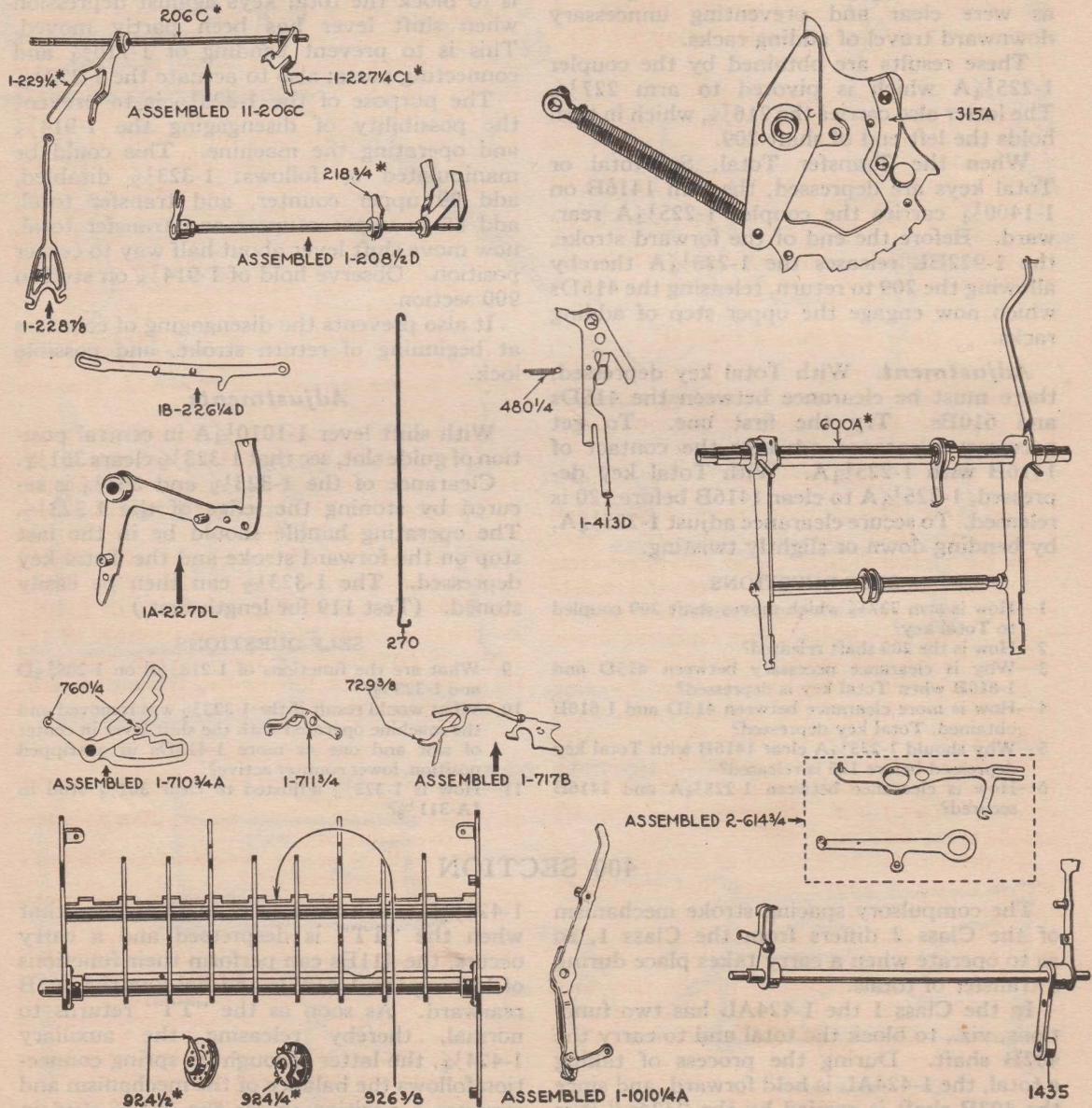
In the Class 1 the 1-424AL has two functions, viz., to block the total and to carry the 402B shaft. During the process of taking a total, the 1-424AL is held forward, and since the 402B shaft is carried by the "424s," it is also held rigidly forward, locking the 411Bs. In the Class 2, during a transfer a carry usually takes place, and for that reason, the shaft 402B must permit the 411Bs to lock the 1-413Ds, therefore, an auxiliary 1-424 $\frac{1}{4}$  is used, which swings freely on the 900 shaft. Its function is to lock the total after a carry takes place. It is spring connected to the

1-424 $\frac{1}{2}$ L which carries the 402B shaft, so that when the "TT" is depressed and a carry occurs, the 411Bs can perform their functions of locking the 1-413Ds and holding the 402B rearward. As soon as the "TT" returns to normal, thereby releasing the auxiliary 1-424 $\frac{1}{4}$ , the latter through its spring connection follows the balance of the mechanism and assumes a position under the 261 $\frac{1}{8}$  stud in the total arm, compelling an extra spacing stroke before taking a grand total.

In the Class 1 the holding of the entire 1-401 in a rearward position is obtained by the 214As which, when a key is depressed, relieves the 411Bs of the tension of the 482 spring. In the Class 2, this is accomplished by a lower extension of the 1-424 $\frac{1}{2}$ R.



## CARRYING PAWLS AND CHARACTER SYMBOLS





Note: Class 2 machines equipped with item counters or semi-automatic keyboard counters have the lower extension of 1-424 $\frac{1}{2}$ R removed, to prevent a count taking place during a "TT" key operation. In order to secure a positive carry during a "TT" operation, spring 482 must have lighter tension or 480 $\frac{1}{4}$  springs having slightly heavier tension should be used on carry pawls 1-413D. A single carry in each column during a "TT" operation should be tested.

#### SELF-QUESTIONS

- 12—Why is the compulsory spacing stroke mechanism of the Class 2 machine different than that of the Class 1?
- 13—What are the functions of the 1-424AL in Class 1?
- 14—What is the function of 1-424 $\frac{1}{4}$ ?
- 15—Why is 1-424 $\frac{1}{4}$  connected to 1-424 $\frac{1}{2}$ L by spring 489?
- 16—What is the purpose of lower extension of 1-424 $\frac{1}{2}$ R.

For illustrations described in the above description, refer to previous page No. 4

#### Carrying Pawls 1-413D

The carrying pawls 1-413D, in Class 2 machines, have an extra lower foot, which is necessary for the operation of the lower adding section.

#### Adjustments

The same tests as those used in the Class 1 machines hold true; however, those tests must be applied to both upper and lower feet.

During a transfer operation the lower counter is drawn in mesh with the adding racks. The cam 924 $\frac{1}{2}$  must clear the lower foot of the 1-413D as the mesh takes place.

It is therefore necessary to test for this clearance as though the adding racks were limiting on a 270 limit. With lower counter clear, transfer total key depressed and handle forward, unhook 480 $\frac{1}{4}$  springs and rock lower counter in and out. Movement of 1-413D indicates no clearance.

To determine the amount of clearance, the test is made as above except that the 480 $\frac{1}{4}$  springs are hooked up and the upper section is rocked in and out of mesh with the 610s. The amount of movement of the 610s indicates the amount of clearance; excess clearance would result in the failure of the 415s engaging the upper step of the 610s when totaling lower counter.

#### SELF-QUESTIONS

- 17—Why is an extra foot on carrying pawl 1-413D necessary?
- 18—What tests are observed in adjusting 1-413D?
- 19—How is clearance of lower cam 924 $\frac{1}{2}$  over foot of 1-413D observed?

#### Character Symbols

The Class 1 machines automatically print symbol characters to identify Non-add, Sub-

total, and Total, from items which are not marked. The Class 2 prints additional symbols, Transfer Total and lower counter items, and distinguishes the regular symbols when in the upper counter, by a dash above and when in the lower counter, by a dash below, the characters.

These results are obtained by locating the character type in printing position, through the index arm, 1-710 $\frac{3}{4}$ A. The latter has two sets of steps acting as stops for the type sector. The front steps are used for the upper and the rear steps for the lower counter. The 1-710 $\frac{3}{4}$ A is operated by the section 11-206C.

The steps of the index arm 1-710 $\frac{3}{4}$ A are brought into position by engagement of the forks of 1-228 $\frac{7}{8}$ . The upper fork when the shift lever is in upper position and the lower, when in lower position. This movement is accomplished by 2-614 $\frac{3}{4}$  and 218 $\frac{3}{4}$  of 1-208 $\frac{1}{2}$ D and shift lever 1-1010 $\frac{1}{4}$ A.

1-228 $\frac{7}{8}$  is connected with 1-227 $\frac{1}{4}$ CL, by link 1-229 $\frac{1}{4}$ , and shaft 206C. 1-227 $\frac{1}{4}$ CL is moved by the operation of Non-add, Transfer Total, Sub-total and Total keys.

The lowest step of 710 $\frac{3}{4}$  locates the lower counter symbol. The printing and non-printing of the lower counter symbol is controlled as follows: The 1310 $\frac{1}{4}$  of the 1-717BR moves forward on each listing stroke. When the 729 $\frac{3}{8}$  of the 1-717B is engaged with 1310 $\frac{1}{4}$  it is drawn forward raising the 717. When the 729 $\frac{3}{8}$  is out of engagement with 1310 $\frac{1}{4}$  no printing takes place. The position of the 729 $\frac{3}{8}$  is governed by the 1-711 $\frac{3}{4}$ , which in turn receives its movement from the shift lever through the 2-614 $\frac{3}{4}$ .

#### SELF-QUESTIONS

- 20—What symbol characters does the Class 1 machine print automatically?
- 21—What additional symbols does the Class 2 machine print automatically?
- 22—How are listed amounts designated, which are added in the lower counter?
- 23—How does the index arm, 1-710 $\frac{3}{4}$ A, limit symbol sector?
- 24—Why are two forks on 1-228 $\frac{7}{8}$  necessary?
- 25—How does arm 2-614 $\frac{3}{4}$  cause the forks of 1-228 $\frac{7}{8}$  to engage studs 760 $\frac{1}{4}$  in 1-710 $\frac{3}{4}$ A?
- 26—How does 1-227 $\frac{1}{4}$ CL locate the index arm 1-710 $\frac{3}{4}$ A?
- 27—How is the symbol sector located when listing in lower counter?
- 28—What prevents printing of a symbol, when listing amounts with shift lever in upper position?
- 29—How is movement of 2-614 $\frac{3}{4}$  accomplished?

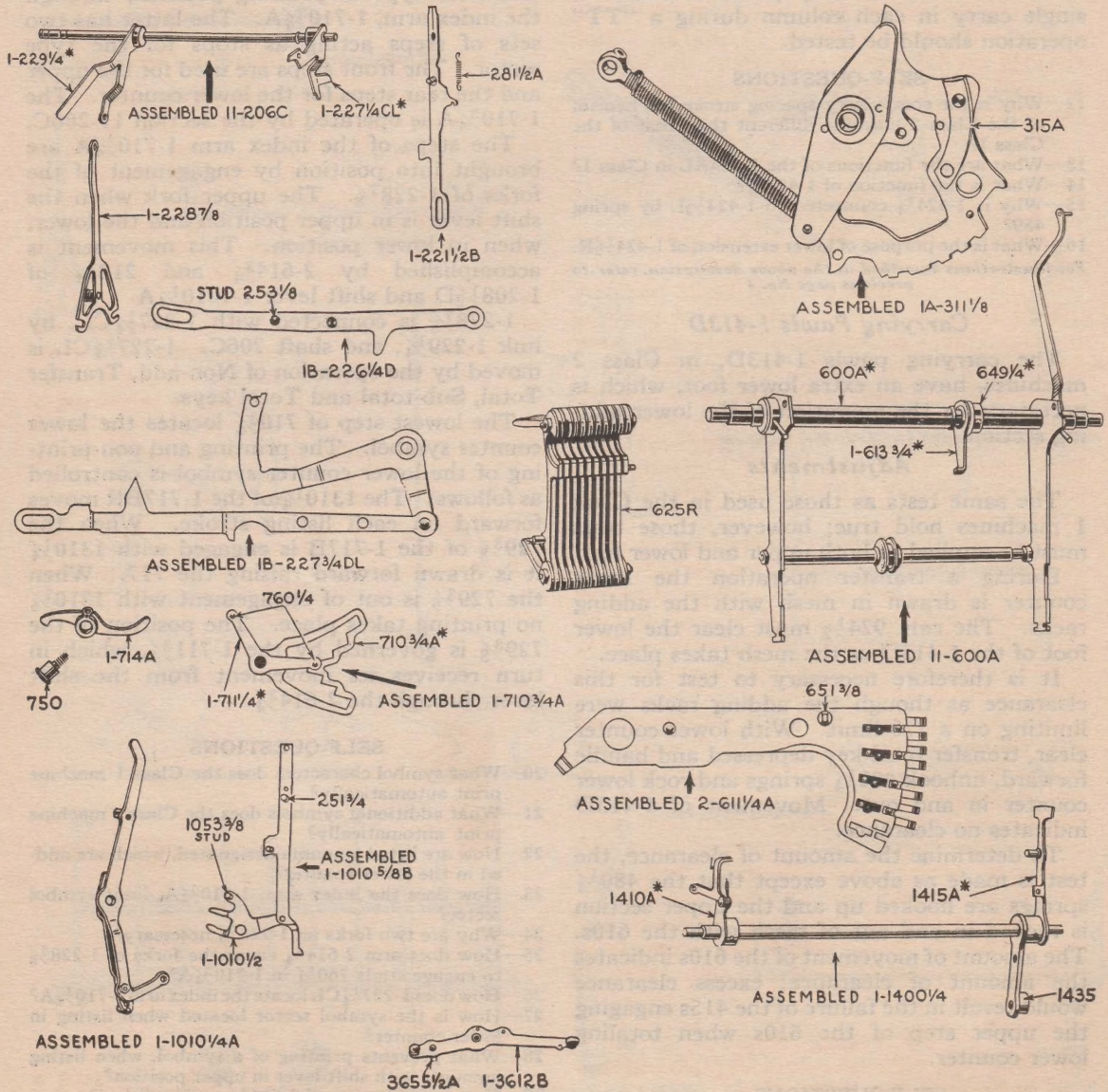
#### Adjustments

To insure accurate indexing of character symbols at all times, a series of tests and adjustments are given covering the 1-710 $\frac{3}{4}$ A, and its connecting parts. It is important that the inspector acquire this knowledge.

The basic limit for the Total, Sub-total



## TOTAL, SUB TOTAL AND TRANSFER TOTAL KEYS





**Pages 9-24 missing**



**Pages 9-24 missing**



- 115—When Carriage Normal key (3420) is released, what blocks the downward movement of outer feed slide (1A-3410 $\frac{1}{4}$ )?
- 116—Why does inner feed slide (1-3410 $\frac{1}{2}$ ) have just one set of jaws?
- 117—When Carriage Normal key is released, why does the machine space up on each alternate stroke?

### Adjustments

With the carriage in Non-add position, arm 1-3424 $\frac{1}{2}$  should not have any lost motion in slot of Keyboard Flash (1-10223). Roll (3433 $\frac{1}{4}$  on 1-3420 $\frac{3}{4}$ ) must clear the highest point of cam 1-3418 $\frac{1}{2}$ . This adjustment can be accomplished by bending arm 3420 $\frac{1}{4}$ .

When arm 1-3420 $\frac{3}{4}$  is in add position, or is on the highest point of cam 1-3418 $\frac{1}{2}$ , there should be clearance between stud 3450 $\frac{1}{8}$  (on 1-3429 $\frac{1}{8}$ A) and 1-3420 $\frac{1}{8}$ .

Inspect 1-3426 $\frac{3}{4}$  R & L for lost motion when engaging stops 1-2893A #8.

With the carriage in right-hand position, handle forward and carriage out of printing position, the feed bail (1-2806 $\frac{1}{4}$ ) and outer feed slide 1A-3410 $\frac{1}{4}$  must be perfectly free.

When the carriage is in right-hand position and Carriage Normal key (3420) is depressed, coupler 3414A must limit on screw (3455 $\frac{3}{8}$ ) in back plate. Feed arm (1-3427) should have slight play at each end of stroke, with carriage in both positions.

When coupler (3414A) is held back by slide (1-3426A) and bail (1-2806 $\frac{1}{4}$ ) is resting on the fingers of inner feed slide (3410 $\frac{1}{2}$ ). Coupler (3414A) should clear top of 3457 $\frac{1}{4}$  stud by  $\frac{1}{2}$ " and must be back far enough over 3457 $\frac{1}{4}$  stud, to prevent bail (1-2806 $\frac{1}{4}$ ) from following down, when handle is pulled.

Also when bail (1-2806 $\frac{1}{4}$ ) is resting on bail stop (2824 $\frac{5}{8}$ ), and the Carriage Normal key is depressed, or the Shuttle Carriage mechanism is operated, causing coupler 3414A to engage with lower foot of inner feed slide 3410 $\frac{1}{2}$ ; the coupler 3414A should have  $\frac{1}{2}$ " clearance under foot of inner feed slide 3410 $\frac{1}{2}$  and should limit on screw 3455 $\frac{3}{8}$ .

In accomplishing this, raise or lower bail stop (2824 $\frac{5}{8}$ ). It may sometimes be necessary to bend lower jaw of inner feed slide (3410 $\frac{1}{2}$ ) either up or down.

### SELF-QUESTIONS

- 118—Why is the full tooth gear (1-3431 $\frac{3}{4}$ A) necessary in shuttle carriage machines?
- 119—When the Carriage Normal key (3420) is depressed what disables the shuttle mechanism?
- 120—How is the movement transmitted from 2A-3400 $\frac{1}{2}$  section to carriage?
- 121—Why are 1-3426 $\frac{3}{4}$ R & L held together with spring 1-3484 $\frac{1}{2}$ ?
- 122—Why is it necessary to change shuttle bar 1A-3418 and 3429 $\frac{1}{2}$  when the throw of carriage is changed?
- 123—What controls the movement of Keyboard Flash (1-10223)?

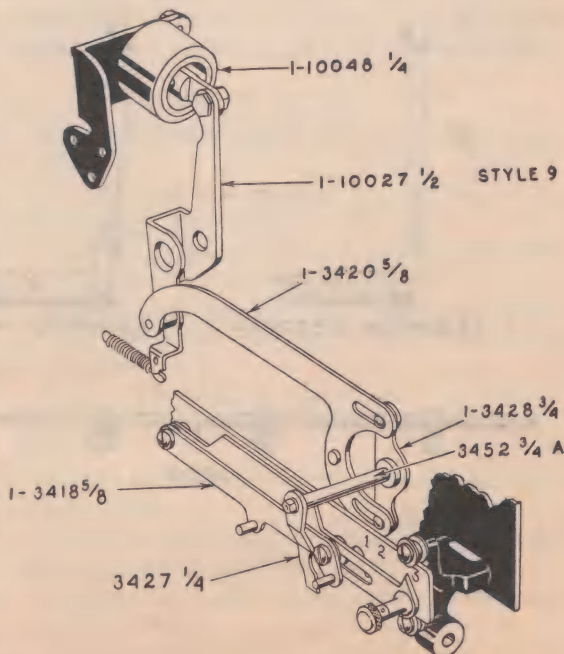
- 124—What is the function of cam 1-3418 $\frac{1}{2}$ ?
- 125—With the roll 3433 $\frac{1}{4}$  (on 1-3420 $\frac{3}{4}$ ) in Non-add position, on cam 1-3418 $\frac{1}{2}$ , what would be the effect on the position of the Non-add signal (1-10223) if arm 3420 $\frac{1}{4}$  was shortened by bending?
- 126—What is the limit for coupler (3414A) when the Carriage Normal key (3420) is depressed and carriage is in right-hand position?
- 127—Why is cam 1-3418 $\frac{1}{2}$  adjustable to three positions?
- 128—Why should 3414A limit on 3455 $\frac{3}{8}$  with Carriage Normal key depressed?
- 129—What is the purpose of 3457 $\frac{1}{4}$  stud?

### Air Cushion for Shuttle Carriage

When the carriage is shuttling, one of the studs in bar 1-3418 $\frac{5}{8}$  rocks arm 3427 $\frac{1}{4}$  on the rear end of shaft 3452 $\frac{3}{4}$ A. Arm 1-3428 $\frac{3}{4}$  on the front end of shaft 3452 $\frac{3}{4}$ A carries two studs which alternately contact in the ends of the slots of part 1-3420 $\frac{5}{8}$ . The movement of part 1-3420 $\frac{5}{8}$  rocks lever 1-10027 $\frac{1}{2}$  which operates the plunger in dash pot 1-10048 $\frac{1}{4}$ . A small hole in the bottom of the dashpot allows the air to escape slowly which absorbs the shock of the carriage coming to a stop. The air outlet is governed by a screw in front of the hole. The air resistance is increased or decreased by turning the screw toward or from the hole. All parts must move freely.

### SELF-QUESTIONS

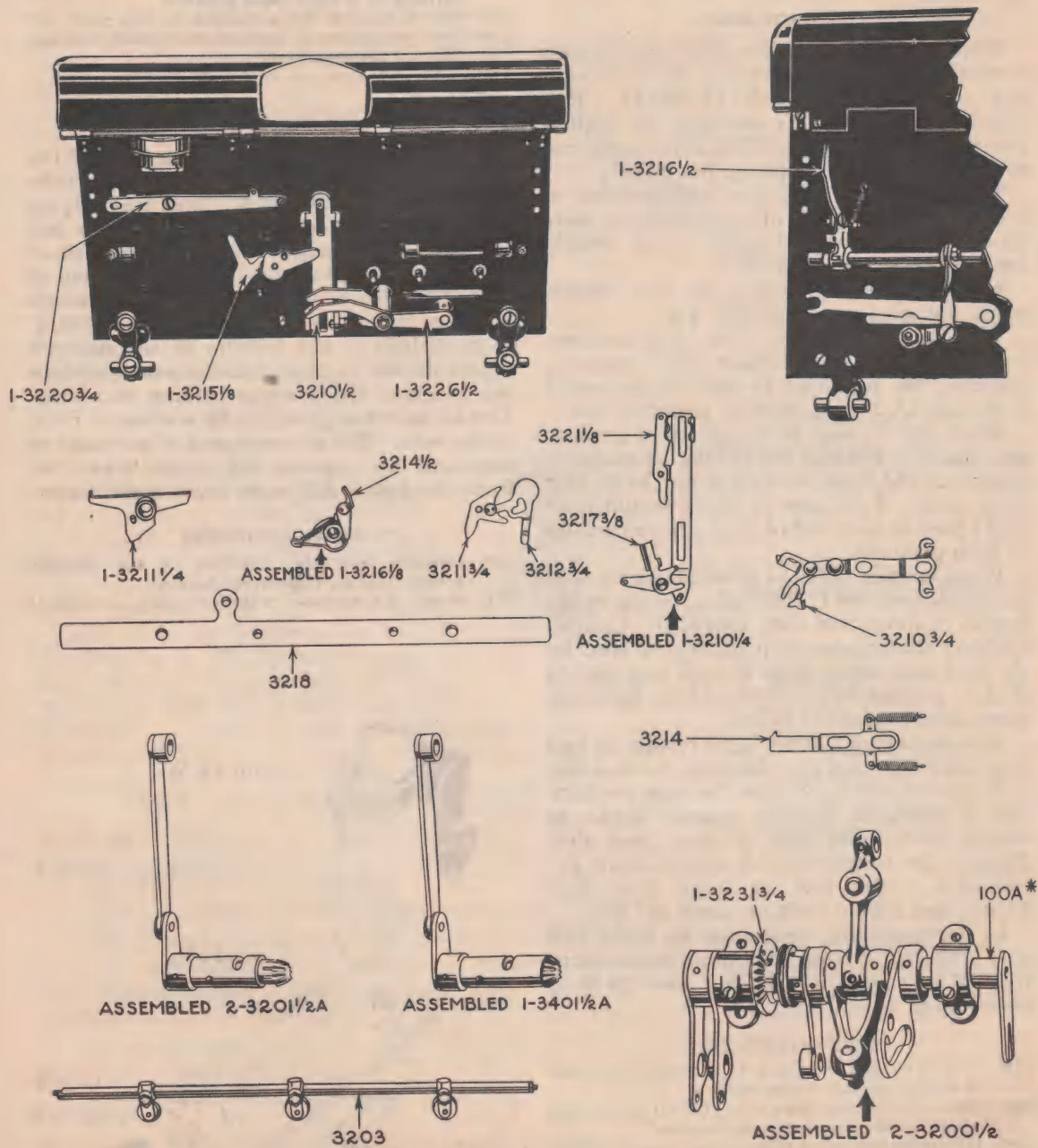
- 130—Describe how the shuttling of the carriage actuates the air cushion mechanism.
- 131—How is the resistance of the air cushion controlled?





## AUTOMATIC COUNTER CONTROL

## AND AUTOMATIC CARRIAGE MECHANISM





### **Automatic Counter Control Mechanism**

In this type of machine the counters shift alternately with each stroke of the handle, provided that both control keys are raised, just as is the case with shuttle carriage machine. The mechanism is practically identical. To prevent the counters shifting when cross tabulating, except as desired, a series of rolls is used carried by the auxiliary bar 3203. These rolls depress cam lever 1-3226 $\frac{1}{2}$  which in turn depresses disengaging arm 1-3216 $\frac{1}{2}$ . This acts in exactly the same manner as the depression of the Counters key, described on Page 20.

### **Automatic Carriage Mechanism**

**The Automatic Carriage** as its name indicates, returns of its own accord to the first printing position. Mechanically it is a combination of the shuttle and semi-automatic carriages. In normal operation, the two feed-slides are connected by means of coupler 3221 $\frac{1}{8}$ , which is thrown in and out of engagement by the disabling arm 1-3220 $\frac{3}{4}$ , attached to the Normal key. In this position, the carriage is stationary, and the platen feeds with each stroke of the handle.

Consider that the carriage has been placed on the first stop, ready for cross-tabulating; the Normal key has been released, and thus disconnected the two feed slides and connected the clutch on the drive shaft.

The inner slide, only, descends with the forward stroke of the handle, while the over-throw stop 3210 $\frac{3}{4}$ , forming the left-hand edge of the stop block, drops down to release the stop-dog and to afford free travel for the carriage.

With the same forward stroke, slide bar 3218 is carried to the left by the semi-circular movement of the crank, and operating dog 1-3211 $\frac{1}{4}$  engages with the second stop. The return of the handle results in the carriage being thrust over to the left a distance equal to the throw of the crank, if the stops have been set up correspondingly.

The same operations are repeated until the stop next to the last, on the right-hand end of the carriage, is reached. The first or left-hand stop is style 4; intermediate stops are style 2; the next to the last is style 1; the right-hand stop is style 3. Stop No. 1 is the same length as the others, but is ground away on the under side.

Thus, when the carriage comes to rest on this stop, cam 1-3215 $\frac{1}{8}$  is permitted to rise a trifle higher than with the other stops. (Note that the cam just referred to forms the right-hand edge of the stop block of which 3210 $\frac{3}{4}$

forms the left.) With the increased travel of the cam, latch 3217 $\frac{3}{8}$  attached to the outer feed-slide is permitted to move far enough to the left to engage with a wing on inner feed-slide 3210 $\frac{1}{2}$ . In this manner, the two feed-slides are coupled and made to operate together with the next stroke of the handle so that the platen is turned one notch after the printing of the item.

Stop No. 1 determines the *last* printing position. At the same time that the handle is describing its forward stroke to print the last item, operating dog 1-3211 $\frac{1}{4}$  contacts with a beveled extension on the under side of the last stop-dog, No. 3; the dog tips down and is latched in that position so that it cannot engage with any stop on the return stroke. Instead, a wing on its right-hand end engages with a cam, 3211 $\frac{3}{4}$ , on the back plate, swings it over, depresses the point of the right-hand block, 1-3215 $\frac{1}{8}$ , and permits the carriage to be drawn over to the right by means of the spring drum which the left-hand travel of the carriage had placed under tension.

Movement of the carriage beyond the first stop 4, is arrested by an elongation on this stop which engages block 3214, the end of which is directly behind the right-hand cam, 1-3215 $\frac{1}{8}$ , previously mentioned. Block 3214 also serves as a buffer to take up any shock due to the rapid return of the carriage.

To restore the tripped operating dog, 1-3211 $\frac{1}{4}$ , an extension on the under side of the first stop contacts with a small lever, 3214 $\frac{1}{2}$ , on the slide bar; throws over latch 1-3216 $\frac{1}{8}$ ; and releases the dog, which immediately takes its normal position, as well as the cams 3211 $\frac{3}{4}$  and 3212 $\frac{3}{4}$  on the back plate.

### **Automatic Carriage Tests**

Number 2 stop-dog and 1-3427 must clear 3210 $\frac{3}{4}$ .

Number 4 stop-dog must clear 3229 $\frac{3}{4}$  when the carriage is moved by hand.

Test the cushion effect of 1-3218 $\frac{1}{2}$  and 3214 with the carriage on number 4 stop.

See that the tail of 1-3215 $\frac{1}{8}$  rests against 3217 $\frac{3}{8}$  when the carriage is held in position by 1-2893A # 1.

When 1-3215 $\frac{1}{8}$  is depressed by No. 2 stop-dog, the 3217 $\frac{3}{8}$  must clear 3210 $\frac{1}{2}$  by  $\frac{1}{32}$ ".

1-3427 must have a slight motion at the end of the stroke.

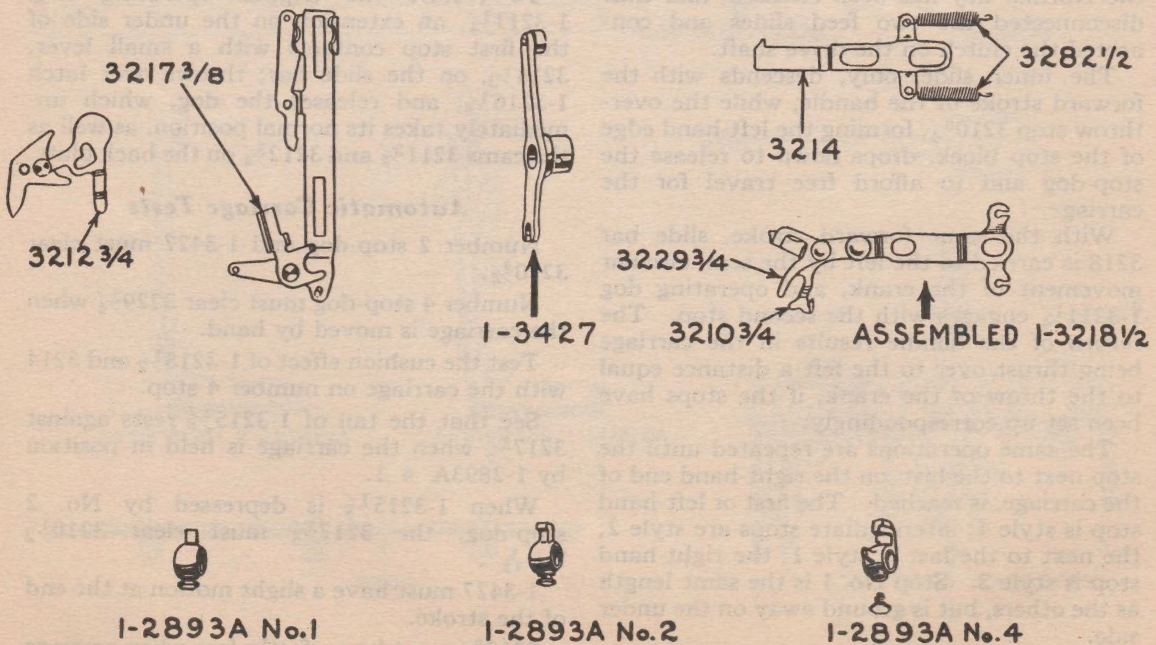
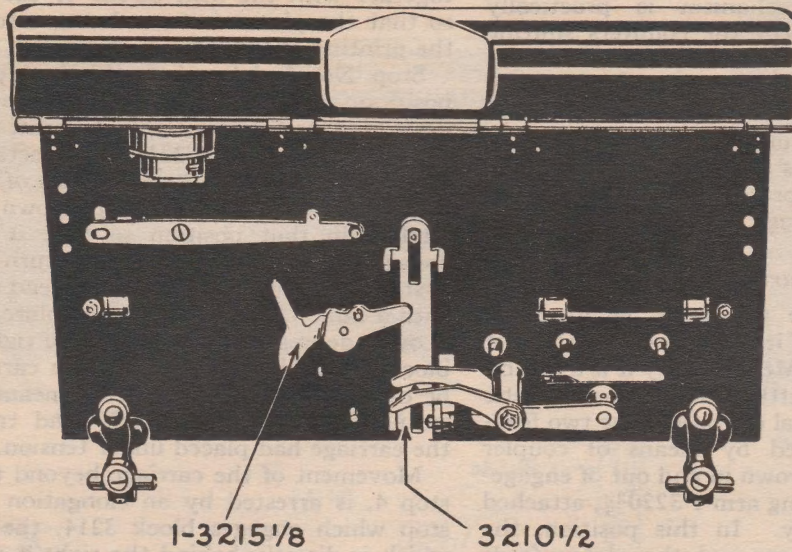
3212 $\frac{3}{4}$  must be perfectly free when carriage is in position to feed the platen.

1-2893A # 2 and 1-2893A # 1 must clear the end of 3214.

1-2893A # 4 must clear 3282 $\frac{1}{2}$ .



# **AUTOMATIC CARRIAGE MECHANISM (CONTINUED)**





## SELF-QUESTIONS

- 132—Why is the spring barrel placed on the opposite side of the machine on an automatic as compared to a semi-automatic?
- 133—When does the platen feed with each stroke of the machine?
- 134—What couples the 1-3210 $\frac{1}{4}$  and 3210 $\frac{1}{2}$  when the Normal key is depressed?
- 135—How does the clutch couple the 1-3231 $\frac{3}{4}$  and drive shaft (100A of 2-3200 $\frac{1}{2}$ )?
- 136—Why is the 1-3231 $\frac{3}{4}$  not a full-tooth gear?
- 137—How does the movement of the 2-3201 $\frac{1}{2}$ A differ from the movement of the 1-3401 $\frac{1}{2}$  on the shuttle carriage machine?
- 138—What limits the distance between stops on an automatic stop bar?
- 139—Why does the No. 1 stop permit the 1-3215 $\frac{1}{8}$  to raise higher than the No. 2 or 4 stops?
- 140—When the Normal key is depressed does the same latch connect the feed slides 1-3210 $\frac{1}{4}$  and 3210 $\frac{1}{2}$  as in automatic tabulation when No. 1 stop is in position on the 1-3215 $\frac{1}{8}$ ?
- 141—Why is a No. 3 stop dog used on an automatic carriage machine?
- 142—When the operating dog 1-3211 $\frac{1}{4}$  is locked down by the 1-3216 $\frac{1}{8}$  what releases it when it reaches the end of the carriage movement?
- 143—What returns the carriage to the right of the machine?
- 144—Why are more than one No. 2 stops used and only one each of the Nos. 1, 3, and 4 on an automatic stop bar set-up?
- 145—Why do the Nos. 4, 1 and 3 stops together give the carriage the same action as a shuttle carriage machine?
- 146—Why are the 3214 and the 1-3218 $\frac{1}{2}$  connected together with two springs (3282 $\frac{1}{2}$ )?



